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LP SD18 – Sunshine Duration Sensor

1 Introduction

The Sunshine Duration sensor LP SD18 measures status and sunshine duration. The WMO (World Meteorological Organization) defines the sunshine duration as the time during which the direct solar radiation exceeds the level of 120 W/m^2.

The LP SD18 performs the measure of radiation with an array of photodiodes arranged in a particular geometry which allows to obtain an accurate measurement in any weather conditions. This solution avoids the use of mechanical moving parts and ensures high reliability over time.

The instrument, besides indicating the presence of sun as required by the WMO, measures also direct radiation (SRD), therefore it can be used as a low cost alternative to a pyrheliometer, which use is bound to a solar tracker.

The instrument is available in three versions, which differ in the type of output:

LP SD18.1 RS485 MODBUS-RTU output and volt-free contact output
(contact closed = SRD ≥ 120 W/m^2, contact open = SRD < 120 W/m^2)

LP SD18.2 RS485 MODBUS-RTU output, analog voltage output 0…1 Vdc, which corresponds to 0…2000 W/m^2 of direct radiation, and digital output voltage
(digital voltage output: 1V = SRD ≥ 120 W/m^2, 0V = SRD < 120 W/m^2)

LP SD18.3 SDI-12 output and volt-free contact output
(contact closed = SRD ≥ 120 W/m^2, contact open = SRD < 120 W/m^2)

The LP SD18 is equipped with a heating element separately powered and galvanically isolated, which prevents the formation of condensation on the glass surface onto which the sensitive elements are placed. For harsh climates, the above-mentioned versions are available with a second heating element (option R, LP SD18.x**R**), which prevents the formation of ice and prevents snow from settling.
The instrument does not need any positioning adjustment during the year and it can be installed on a mast or on a proper fixing base (optional).
The application fields are multiple: from the agronomy (agricultural science) to the study the growth of crops, to photovoltaic systems for verifying their performance, to building automations for automatic opening/closing of blinds, shutters and, in general, to all those areas where it is necessary to monitor the presence of sunlight.

2 Operating Principle

The Sunshine Duration LPSD18 is based on the use of 16 sensors arranged in such a way that, in the presence of sun, at least one of the photo-detectors is exposed to sun light directly from the sun (besides the diffusion component).

Those sensors which are not directly illuminated by the sun are used for the measurement of the diffused light that is subtracted from the measurement of the sensor which sees the sun directly to get direct radiation.

The cylindrical glass protects the sensors and the internal circuits of the instrument from the weather and at the same time provides an excellent transparency to sunlight.

In order to avoid the formation of condensation inside the instrument, in addition to the heating element, the LPSD18 is supplied with a cartridge that must be loaded with desiccant material in colloidal silica (Silica-gel).

3 Technical specifications

Sensitive elements	16 Silicon photodiodes
Spectral range	360…1100 nm
Direct radiation SRD measuring range	0…2000 W/m^2
Accuracy of the measurement of direct radiation	Better than 90% on the monthly total
Accuracy of the measurement of the sunshine duration sensor	Better than 90% on the monthly total
Response time	<1 second
Threshold value	120 W/m^2
Sunshine duration resolution	1 sec
Power supply **Consumption**	7…30 Vdc 5mA @ 12V
Heating system **Anti-condensation device consumption** **Antifreeze device consumption**	12…15 Vdc 1W @ 12V 5W @ 12V ON for internal Temp. < 6 °C, OFF for internal Temp > 10 °C
Internal temperature **Measuring range** **Accuracy**	 -40…+80 °C ± 0.5 °C
Operating temperature	-40…+80 °C
Weight	0.9 kg
Protection degree	IP66
Outputs **LP SD18.1** **LP SD18.2** **LP SD18.3**	 • RS485 MODBUS-RTU • Galvanically isolated contact closed = SRD ≥ 120 W/m^2 open = SRD < 120 W/m^2 • RS485 MODBUS-RTU • Analog output 0…1V (0…2000 W/m^2) • Digital output 0…1V 1V = SRD ≥ 120 W/m^2 0V = SRD < 120 W/m^2 • SDI-12 • Galvanically isolated contact closed = SRD ≥ 120 W/m^2 open = SRD < 120 W/m^2

4 Preparation of the sunshine duration sensor

Before installing the instrument, refill the cartridge containing silica gel desiccant crystals. During loading, avoid wetting or touching the material with the hands as it loses the power desiccant.

The operations to be performed in a dry place (as far as possible) are the following:

1- unscrew the cartridge containing the silica gel by using a coin

2- remove the cartridge perforated cap

3- open the envelope (supplied with the sunshine duration sensor) containing the silica-gel

4- fill the cartridge with the silica-gel

5- close the cartridge with its own cap, by making sure the O-ring seal is correctly located

6- screw the cartridge to the body of the sunshine duration sensor by using a coin

7- check that the cartridge is properly screwed (otherwise the duration of the drying capacity of the silica-gel is strongly reduced)

Fig. 1 briefly illustrates the operations necessary for filling the cartridge with the silica-gel.

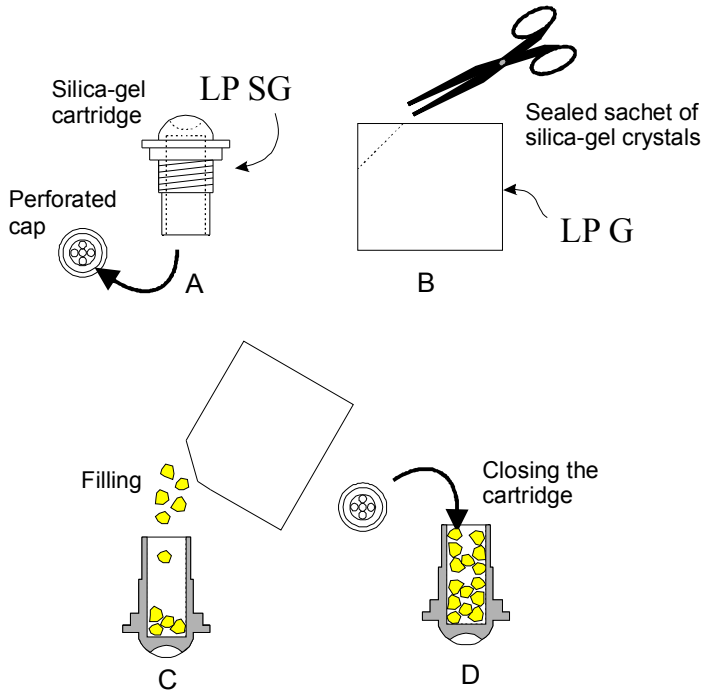


Fig. 1: filling the cartridge with the silica-gel

5 Installation of the sunshine duration sensor

The sunshine duration sensor should be installed in a place easy to be reached for the periodical cleaning of the glass and the maintenance. At the same time, it should be avoided that buildings, trees or obstructions of any kind exceed the horizontal plane on which the sunshine duration is placed. It is acceptable to choose a location where obstacles in the path of the sun from sunrise to sunset is less than 5° from the horizontal plane of the sunshine duration sensor. It should be also checked that there are no reflective elements that may alter the measure.

The LP SD18 does not need any positioning adjustment during the year.

Three installation methods are possible:

- **LP SD18.xB**: basic version for installation on a flat base by using the support included. The Sunshine Duration Sensor has a fixed inclination of 45° with respect to the fixing plane.

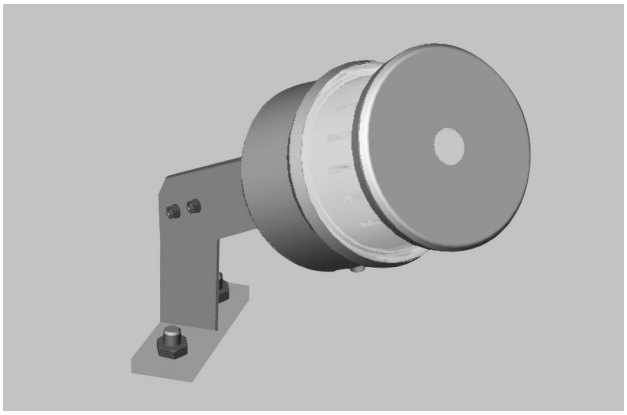


Fig. 2: basic version LP SD18.xB

- **LP SD18.xO**: version for installation on the base **LP SD18.O**. The base allows the inclination of the sensor up to 80° respect to the vertical, so to fit it to the position of the sun to the latitude of the place of installation. Two adjustable feet and one fixed foot allow to put the sensor on an horizontal plane.

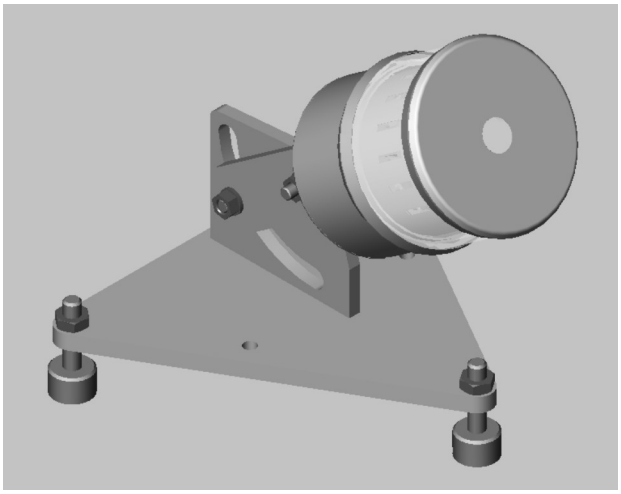


Fig. 3: installation on the base LP SD18.O

- **LP SD18.xV**: version for installation on a vertical Ø 40 mm mast by using the **LP SD18.V** support. This support allows to tilt the sensor up to 80° respect to the vertical, so to fit it to the position of the sun to the latitude of the place of installation.

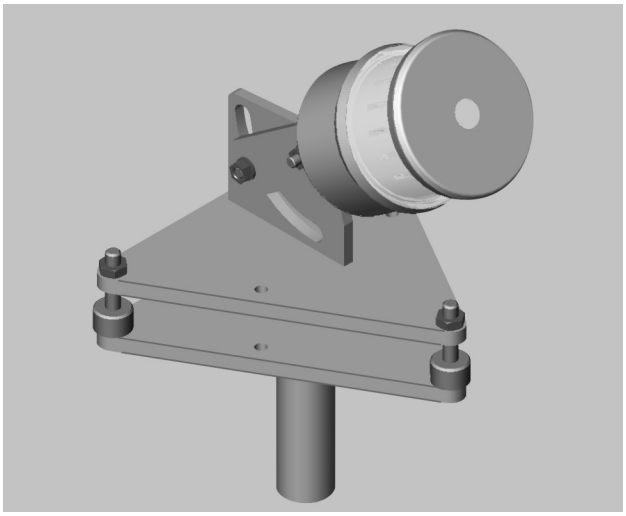


Fig. 4: installation on a vertical mast by using the LP SD18.V support

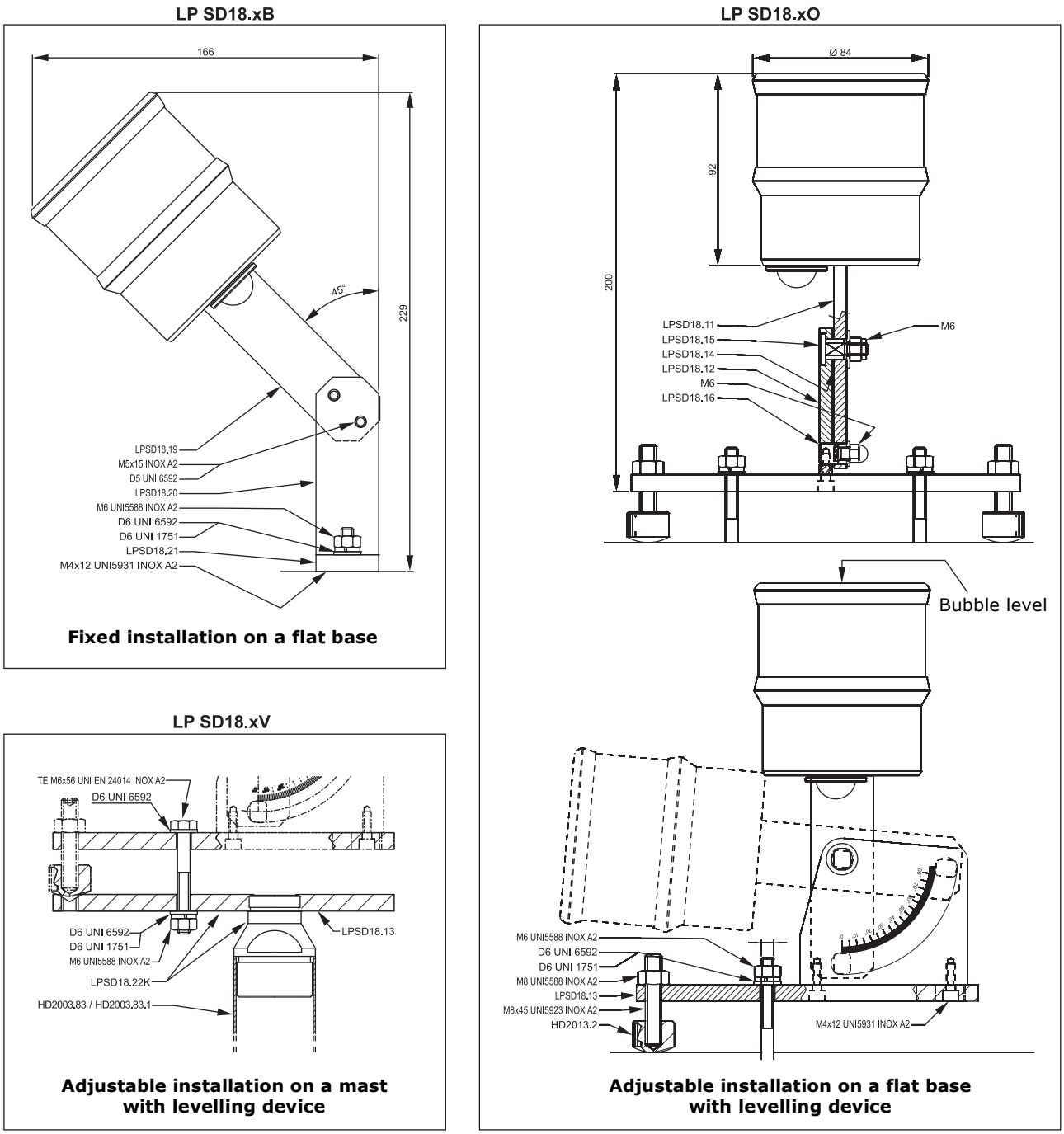


Fig. 5: details of the installation

Before orienting the Sunshine Duration Sensor to its final position, place it vertically and adjust the base (for installation on a plane) or support (for installation on a ø 40 mm mast) feet so that the level on the upper side of the instrument is perfectly levelled (Fig. 6).

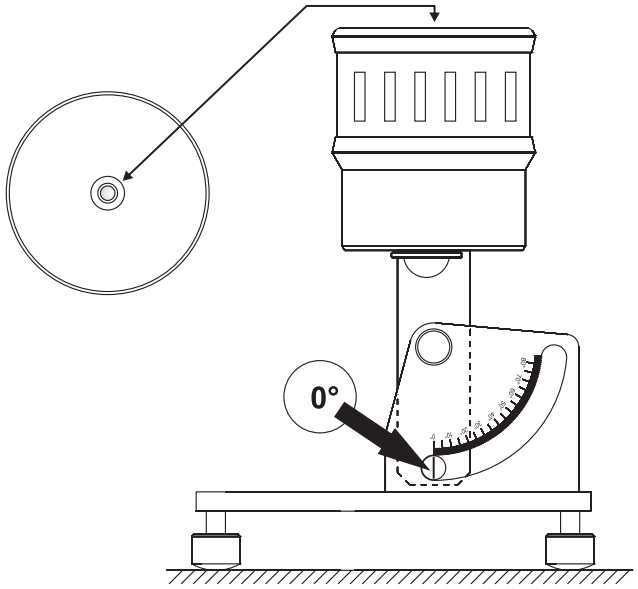


Fig. 6: Levelling of the Sunshine Duration Sensor

Orient the Sunshine Duration Sensor so that the index of the graduated scale of the support matches the value (90° - Latitude) and the top (where the spirit level is placed) is directed towards the NORTH pole, if used in the northern hemisphere, or towards south, if used in the southern hemisphere (Fig. 7).

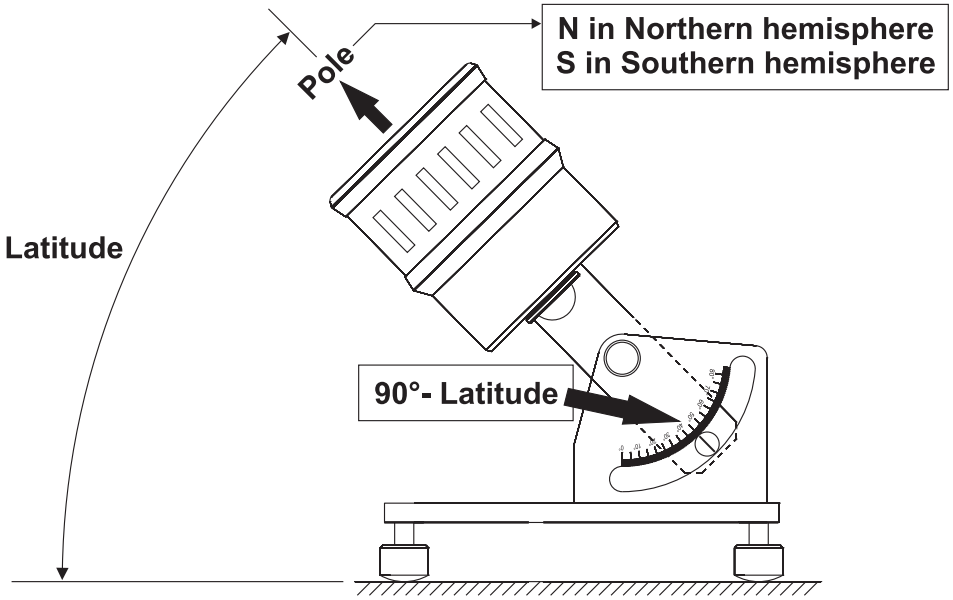


Fig. 7: Orientation of the Sunshine Duration Sensor

The angle that instrument axis should make with respect to the ground is equal to the latitude of the installation site, this way the axis of the instrument will be parallel to the earth axis North-South (Fig. 8).

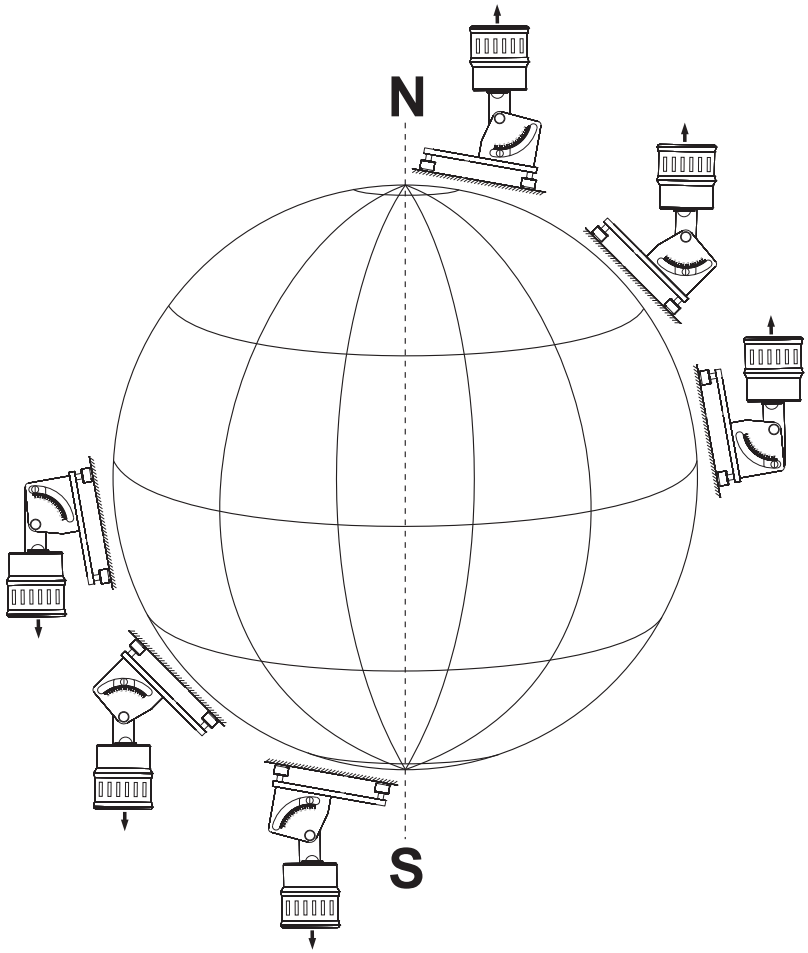


Fig. 8: Sunshine Duration Sensor parallel to the Earth axis

6 Electrical Connections

All the versions of the Sunshine Duration Sensor are equipped with an 8-pin M12 connector. **Upon request, cables with 8-pin M12 female connector with 5 or 10 m standard length are available (other lengths available upon request)**.

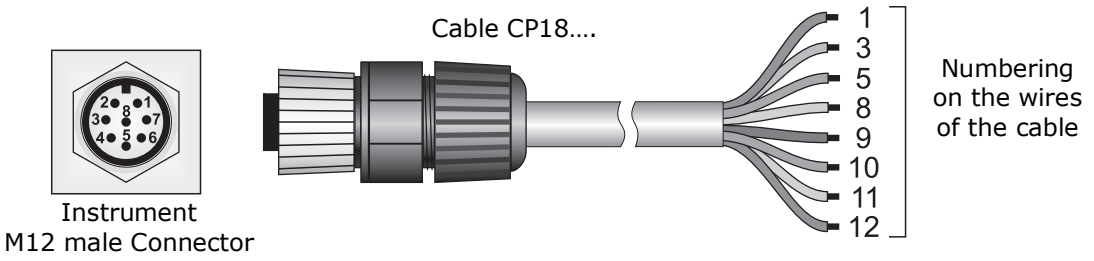


Fig. 9: Connections

LP SD18.1 and LP SD18.1R

Connector Numbering	Function	12-pin cable Numbering
1	Power supply negative	12
2	Power supply positive	1
3	Heating (*)	3
4	RS485 A/-	9
5	RS485 B/+	5
6	Volt-free contact output	8
7	Heating (*)	10
8	Volt-free contact output	11

LP SD18.2 and LP SD18.2R

Connector Numbering	Function	12-pin cable Numbering
1	Power supply negative; 0-1V analog output negative 0-1V digital output negative	12
2	Power supply positive	1
3	Heating (*)	3
4	RS485 A/-	9
5	RS485 B/+	5
6	0-1V digital output positive	8
7	Heating (*)	10
8	0-1V analog output positive	11

LP SD18.3 and LP SD18.3R

Connector Numbering	Function	12-pin cable Numbering
1	Power supply negative	12
2	Power supply positive	1
3	Heating (*)	3
4	NC	
5	SDI-12	5
6	Volt-free contact output	8
7	Heating (*)	10
8	Volt-free contact output	11

(*) The connection of the heating is not polarized, the two wires can be reversed.

7 RS485 MODBUS-RTU Communication

Both **LP SD18.1x** and **LP SD18.2x** are equipped with a RS485 MODBUS-RTU protocol output.

Before connecting the Sunshine Duration Sensor to the RS485 network it is necessary to assign it an address and set the communication parameters, when different from those set by the factory. The setting of the parameters is made by connecting the Sunshine Duration Sensor to a PC by using the supplied 8-pin M12 plug or the CP18… optional cable and an RS485/USB (for ex. RS48) or RS485/RS232 converter.

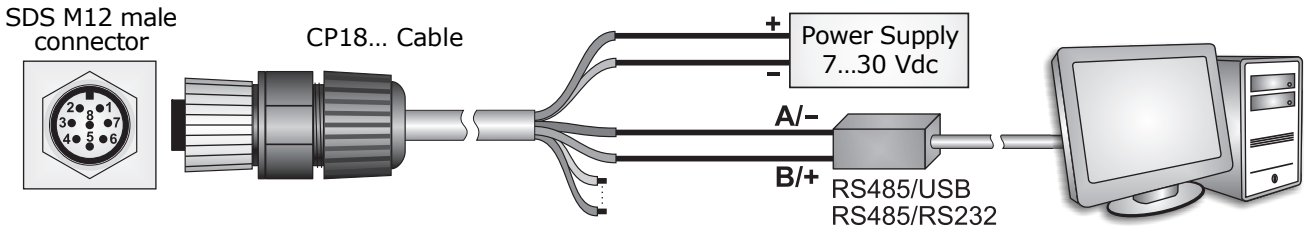


Fig. 10: PC connection

If an RS485/USB converter is used, it is necessary to install the relevant USB drivers in the PC.

NOTES ON THE INSTALLATION OF UNSIGNED USB DRIVER: before installing unsigned USB driver into Windows 7 and 8 operating systems it is necessary to restart the PC by disabling the driver signing request. If the operating system is 64-bit, even after installation the request of driver signing have to be disabled each time the PC is restarted**. Disabling is not necessary if the cable RS48 is used.**

PROCEDURE FOR SETTING THE PARAMETERS:

1. Start when the Sunshine Duration Sensor is not supplied.
2. Start a serial communication program, as Hyperterminal for instance. Set the Baud Rate to 57600 and set the communication parameters as follows:

   data bits: 8, parity: none, stop bits: 2

   In the program, set the COM port number to which the Sunshine Duration Sensor is connecting.
3. Supply the Sunshine Duration Sensor and wait for the character **&** to be displayed, then send the command **@** (within 5 seconds from the power of the sensor) and press the **enter** key.

   Note: if the Sunshine Duration Sensor does not receive the command **@** within 5 seconds since when is powered, the RS485 MODBUS mode is automatically activated. In this case it is necessary to power the instrument off and then on again.
4. Send the command **CAL USER ON**.

   Note: the command CAL USER ON turns off after 5 minutes of inactivity.
5. In order to set the RS485 MODBUS parameters, send the serial commands reported in the following table:

Command	Response	Description
CMAnnn	&|	Set the address RS485 at nnn (1…247). Preset to 1
CMBn	&|	Set the Baud Rate RS485 n=0 ⇒ 9600, n=1 ⇒ 19200. Preset to 1 ⇒ 19200
CMPn	&|	Set the RS485 transmission mode n=0 ⇒ 8N1, n=1 ⇒ 8N2, n=2 ⇒ 8E1 n=3 ⇒ 8E2, n=4 ⇒ 8O1, n=5 ⇒ 8O2 Preset to 2 ⇒ 8-E-1 Note: N=no parity, E=even parity, O=odd parity
CMWn	&|	Set the receiving mode after the RS485 transmission n=0 ⇒ Violate protocol and go in Rx mode right after Tx n=1 ⇒ Respect protocol and wait for 3.5 characters after Tx Preset to 1 ⇒ Respect the protocol

6. It is possible to check the parameter settings by sending the following commands:

Command	Response	Description
RMA	*Address*	Read the RS485 address
RMB	*Baud Rate*	Read RS485 Baud Rate: 0 ⇒ 9600, 1 ⇒ 19200
RMP	*Tx Mode*	Read RS485 transmission mode: 0 ⇒ 8-N-1, 1 ⇒ 8-N-2, 2 ⇒ 8-E-1, 3 ⇒ 8-E-2, 4 ⇒ 8-O-1, 5 ⇒ 8-O-2
RMW	*Rx Mode*	Read reception mode after RS485 transmission n=0 ⇒ Violate protocol and go in Rx mode right after Tx n=1 ⇒ Respect protocol and wait for 3.5 characters after Tx

OPERATING MODE

The instrument enters RS485 MODBUS-RTU mode after 5 seconds from power on. In the first 5 seconds from power on the instrument does not reply to requests from the MODBUS master unit. After 5 seconds, it is possible to send MODBUS requests to the instrument.

Reading of the measures and status of the instrument

The measured values and the status of the instrument can be read in MODBUS mode by using the 04h function code (Read Input Registers). The following table lists the MODBUS Input Registers available:

MODBUS Input Registers

Register number	Register address	Datum	Format
1	0	Internal temperature °C [x10]	16-bit integer
2	1	Internal temperature °F [x10]	16-bit integer
3	2	Direct radiation (SRD, "Direct Sunshine") in W/m^2	16-bit integer
4	3	Status register Bit0=1 ⇒ error in the measure of radiation Bit1=1 ⇒ error in the measure of temperature Bit2=1 ⇒ data memory error Bit3=1 ⇒ program memory error	16-bit integer
5	4	Number of seconds in the last minute with radiation higher than 120 W/m^2 (number between 0 and 60)	16-bit integer
6	5	Number of tens of seconds in the last 10 minutes with radiation ≥ 120 W/m^2 (number between 0 and 60: for each interval of 10 s, in the last 10 minutes, is counted a 1 if SRD ≥ 120 W/m^2 for at least 5 s) For a higher resolution use the register number 5.	16-bit integer
7	6	Status of the sun presence/absence contact 0 = SRD < 120 W/m^2 (open contact) 1 = SRD ≥ 120 W/m^2 (closed contact)	16-bit integer
8	7	Status of heating: 0 = off, 1 = on	16-bit integer
9	8	Temperature in °C [x10] below which the heating turns on	16-bit integer
10	9	Circular counter from 0 to 32767 of the measuring cycles. It is increased after each measurement.	16-bit integer

Change of the heating activation temperature

The temperature below which the heating turns on can be changed by using 06h function code (Write Single Register) to write the value in the Holding Register number 3 (address 2). The value must be set in tenths of degrees between -450 (-45.0 °C) and 700 (+70.0 °C).

The write 06h function changes only the value in the RAM memory, the change is therefore cancelled in case of power supply failure in the instrument. To make the change permanent, write the hexadecimal value FF00 in the Coil Register number 3 (address 2) by using the 05h function code (Write Single Coil).

To check if the permanent storage has been completed successfully, verify that the Holding Register number 2 (address 1) contains the value 0, by using the 03h function code (Read Holding Registers).

MODBUS Coils

Register number	Register address	Datum
3	2	Permanent storage of the heating activation temperature.

MODBUS Holding Registers

Register number	Register address	Datum	Format
1	0	Indicator of the correct interpretation of the last Modbus command sent. If 0, the command has been executed correctly. If 1, command execution errors occurred.	16-bit integer
2	1	Indicator of the correct permanent storage of heating activation temperature. If 0, the temperature has been stored correctly. If 1, storage errors occurred.	16-bit integer
3	2	Temperature in °C [x10] below which the heating turns on	16-bit integer

Check of the correct interpretation of the MODBUS commands

To check if the last MODBUS command sent to the instrument has been interpreted correctly, verify that the Holding Register number 1 (address 0) contains the value 0, by using the 03h function code (Read Holding Registers).

Connection of the instrument

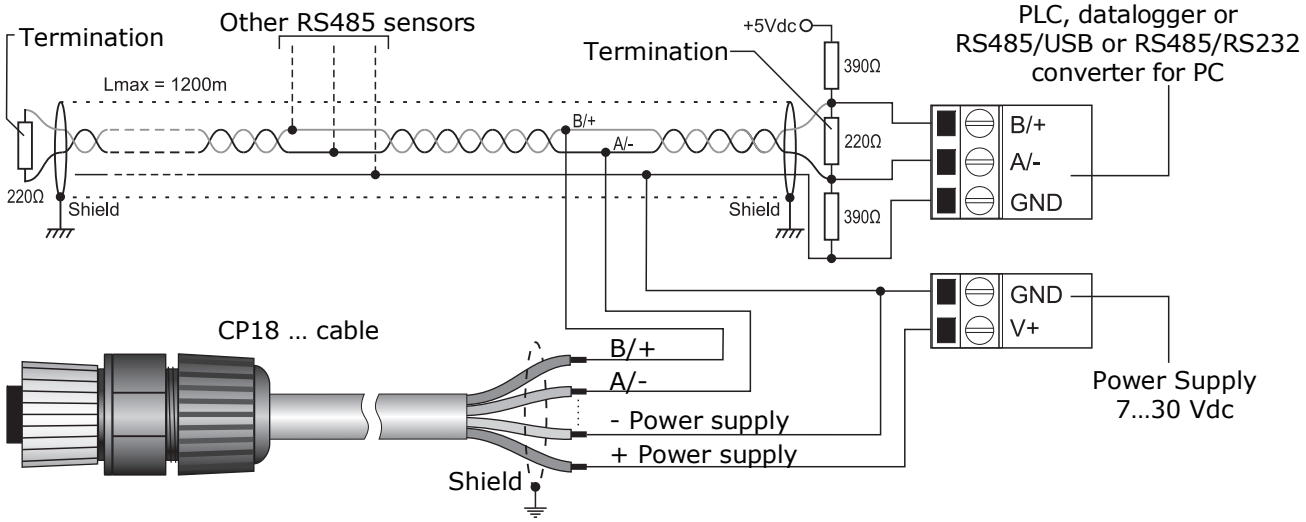


Fig. 11: RS485 connection

8 SDI-12 Communication

The **LP SD18.3x** is equipped with an SDI-12 communication interface compliant with the version 1.3 of the protocol, which allows the connection to SDI-12 sensor networks.

The communication parameters of the PC or of the data logger should be set as follows:

baud rate: 1200, data bits: 7, parity: Even, stop bits: 1

The communication with the instrument is performed by generating a *Break signal* on the serial line for at least 12 ms and then by sending a command in the following form:

<Address><Command>!

with <Address> = address of the instrument the command is sent to
<Command> = type of operation requested to the instrument

The instrument reply is as follows:

<Address><Data><CR><LF>

with <Address> = address of the instrument which replies
<Data> = information sent by the instrument
<CR> = ASCII character *Carriage Return*
<LF> = ASCII character *Line Feed*

The LPSD18-3x comes with a factory address preset to 0. The address can be modified by using the proper SDI-12 command reported in the following table.

The following table reports the SDI-12 commands available. To comply with the SDI-12 standard, the instrument address is indicated in the table with the letter **a**.

SDI-12 Commands

Command	Instrument reply	Description
a!	a<CR><LF>	Verifies the presence of the instrument.
aI!	allccccccccmmmmmmvvvssssssss<CR><LF> with: a = address of the instrument (1 character) ll = SDI-12 compliant version (2 characters) cccccccc = manufacturer (8 characters) mmmmmm = instrument model (6 characters) vvv = firmware version (3 characters) ssssssss = serial number (8 characters) ⇒ Example of response: 013DeltaOhmLPSD1810013201518 with: 0 = instrument address 13 = SDI-12 version 1.3 compliant DeltaOhm = manufacturer's name LPSD18 = instrument model 100 = firmware version 1.0.0 13201518 = serial number	Requests for information from the instrument.
aAb! Where: b = new address	b<CR><LF> Note: if the b character is not an acceptable address, the instrument responds with a instead of b.	Modification of the instrument address.
?!	a<CR><LF>	Request of the address of the instrument. If more than one sensor is connected to the bus, a conflict occurs.

Command	Instrument reply	Description
TYPE M COMMANDS (START MEASUREMENT)		
Insolation status		
aM!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that datum is immediately available.	Request of detection of the insolation status (presence or absence of sun).
aD0!	a+x<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2 ⇒ Example of response: 0+0 The instrument with address 0 measures SRD < 120 W/m^2	Reads the status of insolation (presence or absence of sun).
Direct Solar Radiation		
aM1!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that datum is immediately available.	Request for performing the measurement of direct solar radiation (SRD) in W/m^2.
aD0!	a+rrrr<CR><LF> with: rrrr = SRD with resolution 1 W/m^2 ⇒ Example of response: 0+0135 The instrument with address 0 measures SRD = 135 W/m^2	Reads the measurement of direct solar radiation (SRD) in W/m^2.
State and duration of sunshine		
aM2!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measures available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that data are immediately available.	Request for detecting status and lasting of insolation.
aD0!	a+x+mm+dd+nnnnn<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2 mm = number of seconds in the last minute with x=1 dd = number of tens of seconds in the last 10 minutes with x=1 (dd=0…60: for each interval of 10 s, a 1 is added if x=1 for at least 5 s) nnnnn = circular counter of the measuring cycles number. ⇒ Example of response: 0+1+25+12+00048 The instrument with address 0 measures x=1, in the last minute there have been 25 s with x=1, in the last 10 min there have been from 60 to 120 s with x=1, 48 measuring cycles have elapsed since the counter reset.	Reads status and lasting of isolation.
Internal temperature and heating status		
aM3!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measures available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that data are immediately available.	Request of detecting the internal temperature and the heating status.
aD0!	a+nn.d+n<CR><LF> with: nn.d = internal temperature in °C n = 0 when heating OFF, n = 1 when heating ON ⇒ Example of response: 0+15.3+0 the instrument with address 0 measures 15.3 °C of internal heating and the heater is switched off.	Reads the internal temperature and the heating status.

Command	Instrument reply	Description
TYPE C COMMANDS (START CONCURRENT MEASUREMENT)		
Insulation status		
aC!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that datum is immediately available.	Request of detection of the insolation status (presence or absence of sun).
aD0!	a+x<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2	Reads the status of insolation (presence or absence of sun).
Direct solar radiation		
aC1!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measure available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that datum is immediately available.	Request for performing the measurement of direct solar radiation (SRD) in W/m^2.
aD0!	a+rrrr<CR><LF> with: rrrr = SRD with resolution 1 W/m^2	Reads the measure of the direct solar radiation (SRD) in W/m^2.
Status and lasting of insolation		
aC2!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measures available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that data are immediately available.	Request for detecting status and lasting of insolation.
aD0!	a+x+mm+dd+nnnnn<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2 mm = number of seconds in the last minute with x=1 dd = number of tens of seconds in the last 10 minutes with x=1 (dd=0…60: for each interval of 10 s, a 1 is added if x=1 for at least 5 s) nnnnn = circular counter of the measuring cycles number	Reads status and lasting of insolation.
Internal temperature and heating status		
aC3!	atttn<CR><LF> with: ttt = number of seconds necessary for the instrument to make the measures available (3 characters) n = number of detected variables (1 character) Note: ttt = 000 means that data are immediately available.	Request of detecting the internal temperature and the heating status.
aD0!	a+nn.d+n<CR><LF> with: nn.d = internal temperature in °C n = 0 when heating OFF, n = 1 when heating ON	Reads the internal temperature and the heating status.

Command	Instrument reply	Description
TYPE R COMMAND (CONTINUOUS MEASUREMENTS)		
aR0!	a+x<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2	Reads the status of insolation (presence of absence of sun).
aR1!	a+rrrr<CR><LF> with: rrrr = SRD with resolution 1 W/m^2	Reads the measure of the direct solar radiation (SRD) in W/m^2
aR2!	a+x+mm+dd+nnnnn<CR><LF> with: x = 0 if SRD < 120 W/m^2, x = 1 if SRD ≥ 120 W/m^2 mm = number of seconds in the last minute with x=1 dd = number of tens of seconds in the last 10 minutes with x=1 (dd=0…60: for each interval of 10 s, a 1 is added if x=1 for at least 5 s) nnnnn = circular counter of the measuring cycles number	Reads status and lasting of insolation.
aR3!	a+nn.d+n<CR><LF> with: nn.d = internal temperature in °C n = 0 when heating OFF, n = 1 when heating ON	Reads internal temperature and status of heating

In addition to the above-mentioned commands, LPSD18.3x also implements the corresponding commands with CRC, that require to add a 3-character CRC code at the end of the reply before <CR><LF>. The format of these commands is obtained from the previous by adding the letter C: aMC!, aMC1!, aMC2!, aMC3!, aCC!, aCC1!, aCC2!, aCC3!, aRC0!, aRC1!, aRC2!, aRC3!

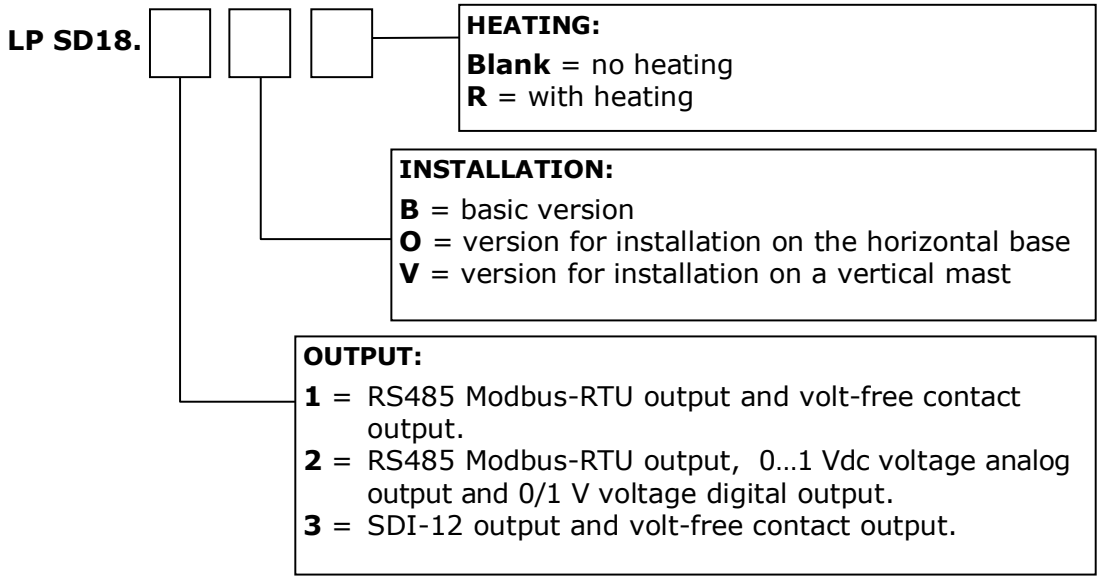
For more information about the protocol, visit the website "www.sdi-12.org".

9 Maintenance:

In order to ensure the declared high accuracy of the measures it is necessary that the protective glass is kept clean. Cleaning can be performed with optical microfiber cloths for camera lenses and with some water, if not enough, use pure ethyl alcohol. After cleaning with alcohol it is necessary to wash the surface with water and dry thoroughly.

In order to avoid the formation of condensation, a heating element is present inside the instrument (1W @ 12 Vdc when connected); moreover a special cartridge with desiccant material is included, that prevents the condensation also in the case where it is not possible to use the heating (for example, to reduce consumption). The efficiency of Silica-gel decreases over time due to moisture absorption. When crystals of silica gel are efficient their colour is **yellow**; when gradually losing their efficiency the colour turns **blue**. The user manual of the instrument describes the procedure for replacing them. Typically, the duration of the silica gel varies from 2 to 6 months depending on the environmental conditions in which the sunshine duration sensor is working.

10 Ordering codes


LP SD18.
HEATING:
Blank = no heating
R = with heating
INSTALLATION:
B = basic version
O = version for installation on the horizontal base
V = version for installation on a vertical mast
OUTPUT:
1 = RS485 Modbus-RTU output and volt-free contact output.
2 = RS485 Modbus-RTU output, 0…1 Vdc voltage analog output and 0/1 V voltage digital output.
3 = SDI-12 output and volt-free contact output.

LP SD18.1 Sensor for measuring sunshine duration, referred to the 120 W/m^2 threshold of direct radiation, according to WMO indications. This sensor has no moving parts. RS485 MODBUS-RTU output and volt-free contact output (CLOSED= radiation above the threshold, OPEN = radiation below the threshold). Power supply 7…30 Vdc. It can be fixed on a mast (option **V**) with a suitable accessory or installed on an horizontal surface (option **O**) by using the optional mounting base. Built-in spirit level for levelling. The sensor does not require any adjustment of its position during the year. Equipped with anti-condensation system (1W @ 12 Vdc). 8-pin M12 connector included. 5 or 10 m standard cables with 8-pin M12 female connector are available upon request.
Available with heating option (option **R**) for installation in harsh climates, for the removal of ice and snow. Activation of heating below +6 °C. Power absorbed by heating: 5W @ 12 Vdc.

LP SD18.2 Sensor for measuring sunshine duration, referred to the 120 W/m^2 threshold of direct radiation, according to WMO indications. This sensor has no moving parts. RS485 MODBUS-RTU output, 0…1 Vdc voltage analog output corresponding to 0…2000 W/m^2 of direct radiation, voltage digital output (1V = radiation above the threshold, 0V = radiation below the threshold). Power supply 7…30 Vdc. It can be fixed on a mast (option **V**) with a suitable accessory or installed on an horizontal surface (option **O**) by using the optional mounting base. Built-in spirit level for

levelling. The sensor does not require any adjustment of its position during the year. Equipped with anti-condensation system (1W @ 12 Vdc). 8-pin M12 connector included. 5 or 10 m standard cables with 8-pin M12 female connector are available upon request.
Available with heating option (option **R**) for installation in harsh climates, for the removal of ice and snow. Activation of heating below +6 °C. Power absorbed by heating: 5W @ 12 Vdc.

LP SD18.3 Sensor for measuring sunshine duration, referred to the 120 W/m^2 threshold of direct radiation, according to WMO indications. This sensor has no moving parts. SDI-12 output and volt-free contact output (CLOSED= radiation above the threshold, OPEN = radiation below the threshold). Power supply 7…30 Vdc. It can be fixed on a mast (option **V**) with a suitable accessory or installed on an horizontal surface (option **O**) by using the optional mounting base. Built-in spirit level for levelling. The sensor does not require any adjustment of its position during the year. Equipped with anti-condensation system (1W @ 12 Vdc). 8-pin M12 connector included. 5 or 10 m standard cables with 8-pin M12 female connector are available upon request.
Available with heating option (option **R**) for installation in harsh climates, for the removal of ice and snow. Activation of heating below +6 °C. Power absorbed by heating: 5W @ 12 Vdc.

ACCESSORIES

LP SD18.O Base for installation of the sunshine duration sensor on a horizontal plane. Two adjustable feet and one fixed foot. Allows the inclination of the sensor up to 80° from the vertical, to suit the position of the sun to the latitude of the place of installation.

LP SD18.V Support for installation of the sunshine duration sensor on a mast Ø 40 mm. Allows the inclination of the sensor up to 80° from the vertical, to suit the position of the sun to the latitude of the place of installation.

LP SD18.19K Basic support for installation of the sunshine duration sensor on a plane. The sunshine duration sensor has 45° fixed inclination with respect to the fixing plane.

LP SD18.22K Support for installation of the base LP SD18.O on a Ø 40 mm mast.

HD 2003.83 ∅ 40 mm mast, 1.5 m length for version **V**. M37x2 mm thread.

HD 2003.83.1 ∅ 40 mm mast, 750 mm length for version **V**. M37x2 mm thread.

LP SG Cartridge for containing crystals of silica gel with O-ring.

LP G Pack of 5 cartridges of the silica-gel.

CP 18.5 12- pole cable. 5 m long. 8-pin M12 connector on one side, free wires on the other side.

CP 18.10 12- pole cable. 10 m long. 8-pin M12 connector on one side, free wires on the other side.

RS 48 RS485 connection cable with built-in USB/RS485 converter. The cable is equipped with a USB connector for the connection to a PC on one side and 3 separated wires on the instrument side.

R Heating option for installation in harsh climates, for the removal of ice and snow. Activation of heating below +6 °C. Power absorbed by heating: 5W @ 12 Vdc.

The quality level of our instruments is the result of continuous product development. This can lead to differences between the information written in this manual and the instrument you have purchased. We can not entirely exclude errors in the manual, for which we apologize.
The data, figures and descriptions contained in this manual can not be legally asserted. We reserve the right to make changes and corrections without notice.

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